

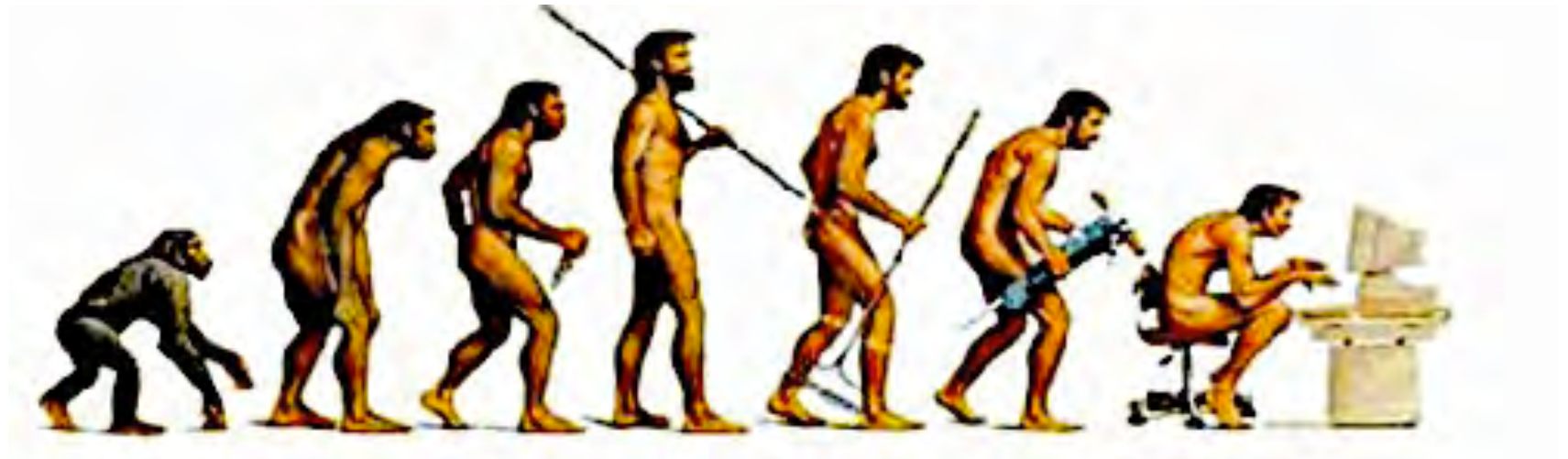
Web Services that Foster Innovation in Buildings Energy Analysis Tools

Evan Mills and Paul Mathew
Lawrence Berkeley National Laboratory

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Thanks to the Home Energy Saver and EnergyIQ core teams:
Norm Bourassa, Leo Rainer, Rich Brown, Greg Homan, Danny Parker, and
Andrea Mercado

Evolution of Energy Software Tools



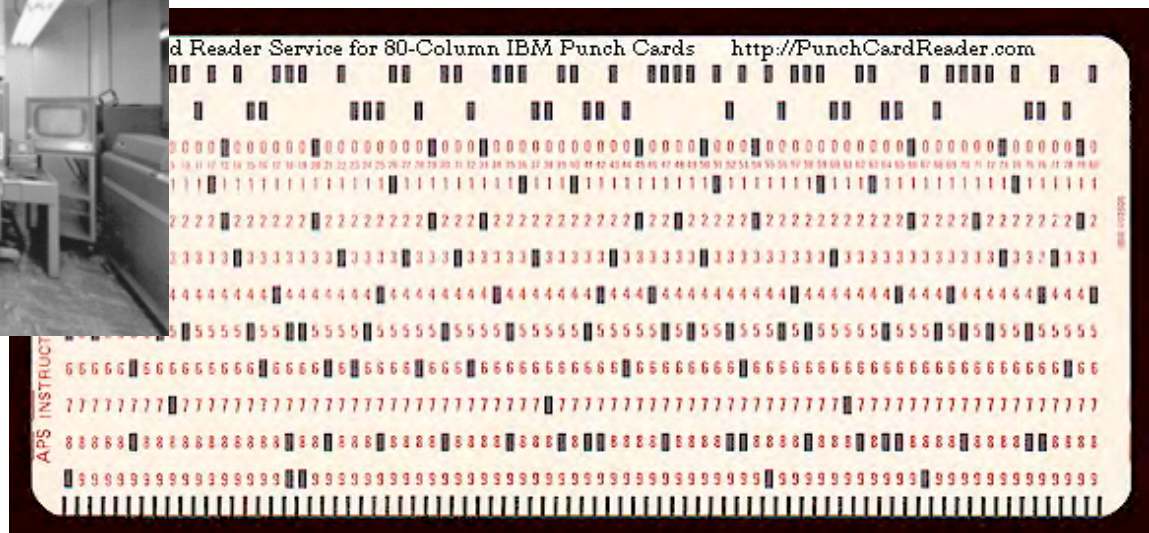
Hand Calculations

$UA\Delta T$ + infiltration + solar

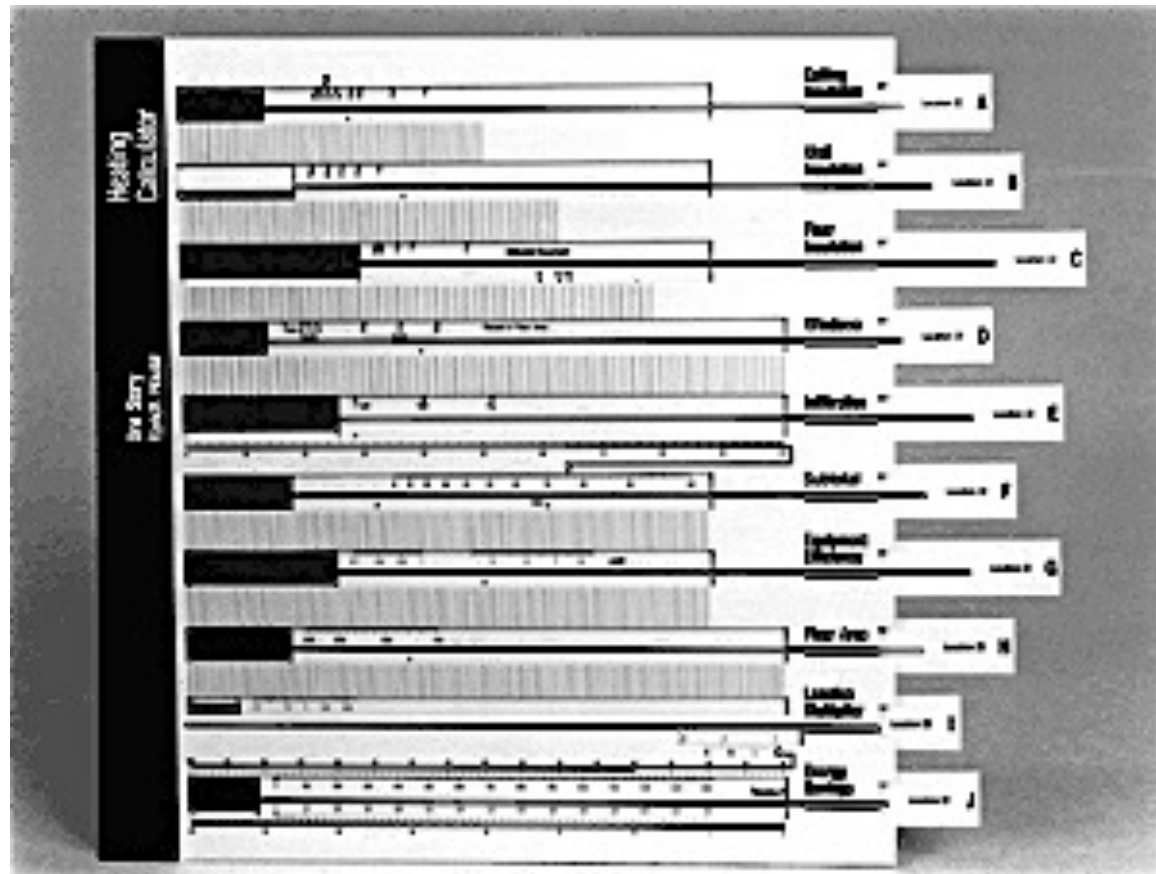


Mainframes

- Room-sized computers; painful input; no GUI; massive output
 - very narrow user base
 - runtime measured in hours



Lookups & Nomographs



Desktop Machines

- Disk-based
 - hundreds or thousands of users
 - runtime measured in minutes



195kb capacity



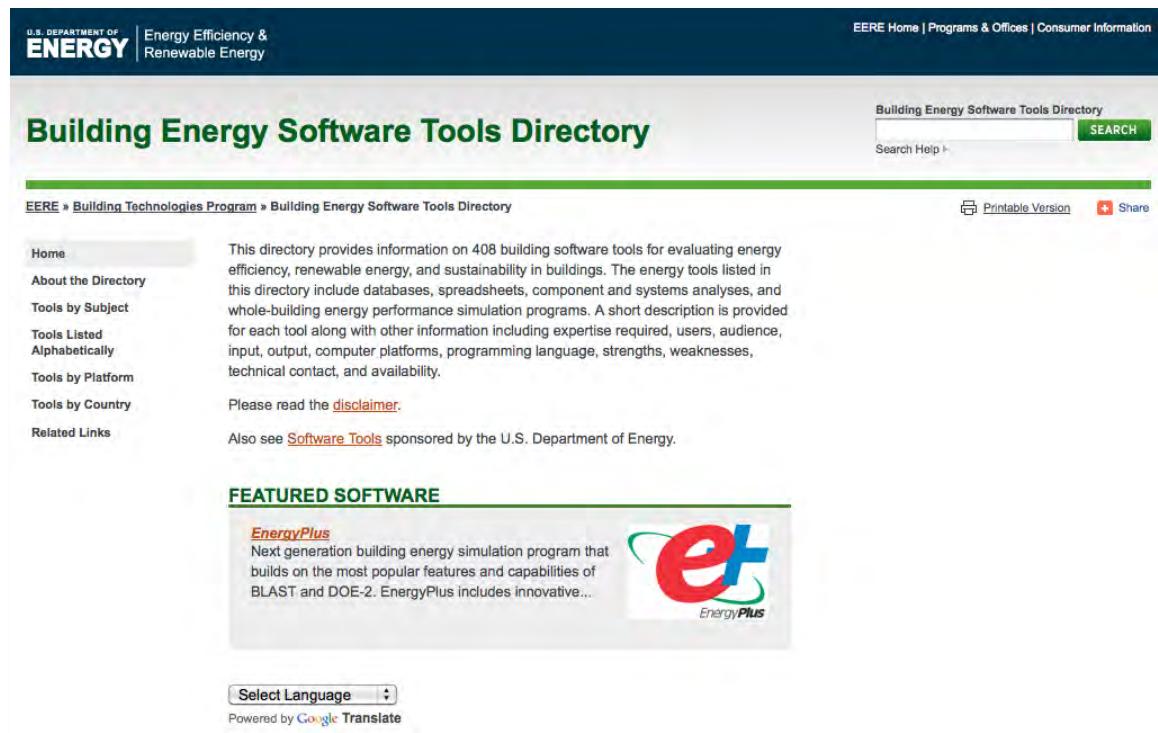
Web-based

- Cloud-hosted applications with friendly GUIs
 - millions of users (including DIY)
 - runtime measured in seconds



At Least 400 Tools Now Exist

- Vibrant differentiation, but also a lot of redundancy in effort/cost (and inconsistency in results)

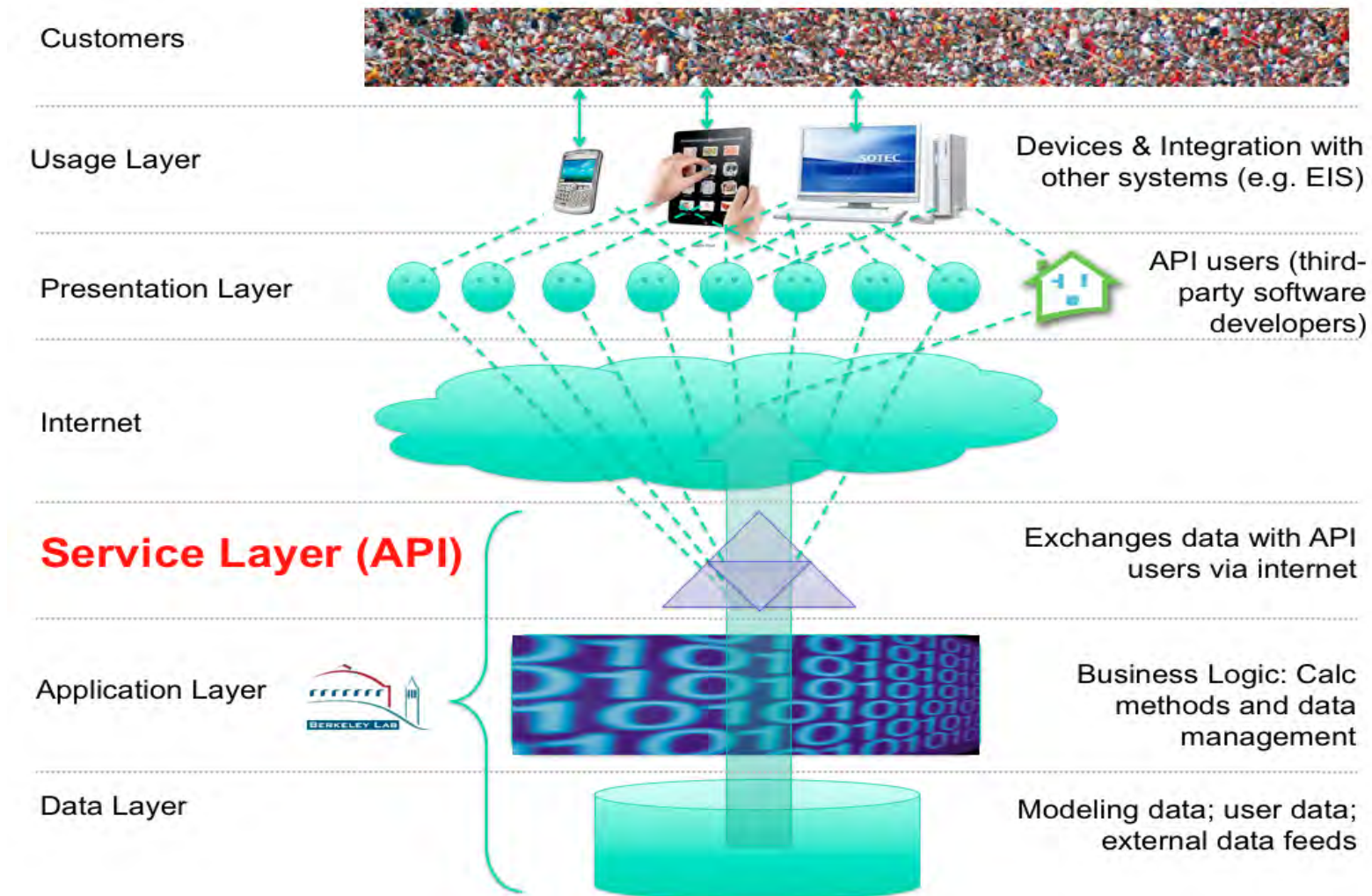


Software as a Service → APIs



What is an API, anyway?

APIs are protocols through which the a host computer and a client computer communicate and exchange data, leaving client free to decide how to gather input data from its customers and how to present them with results



APIs

Pros

- Speeds and simplifies syndication of models and databases
- Radically lowers the cost of entry for private software developers
- Developers can focus more on front-end
- Enables more rapid innovation and differentiation of tools
- Facilitates more internal consistency in methodology and data across proliferation of tools
- Ameliorates stereotypical separation between “public” and “private” tools

Cons

- Requires web-infrastructure
- Derivative tools all depend on single API provider
- Initial development is slower; user support
- Developers need special skills and to be able to understand and adapt to outside service and support paradigm
- Requires very explicit documentation for third-party developers

LBNL APIs and Early Implementations



- **Home Energy Saver (Consumer & Pro versions)**
 - Whole-building simulation, including hourly HVAC (DOE2.1E)
 - Models/algorithms for all other end uses
 - Flexibility to model utilization and other behavioral variables
 - Defaults for every input
 - Whole building and end-use results: Energy / Costs / Emissions
 - Upgrade recommendations



- **Home Energy Scoring Tool**
 - HES Operational approach => Asset rating approach
 - Answers required (no user defaults)
 - Creates PDF label and upgrades list



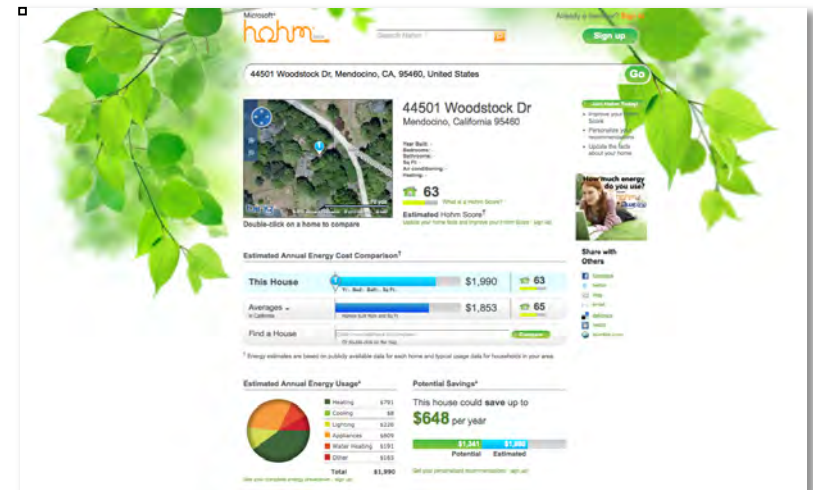
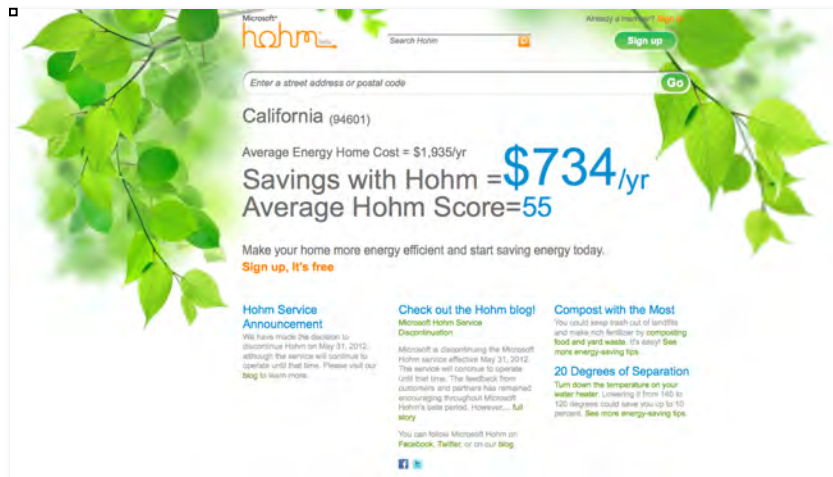
- **EnergyIQ**
 - Non-residential energy benchmarking
 - 62 building types
 - 85 features/characteristics
 - 9 metrics (energy / costs/ emissions)
 - 4 chart types
 - Recommendations
 - Portfolio Manager import

API Deployment

- About 300 entities have expressed interest in these APIs
- Within the first year, more than 50 entities (public and private) became users.
- Some launched products, others still working, others fell away
- More runs are generated via our APIs now than via our own GUIs

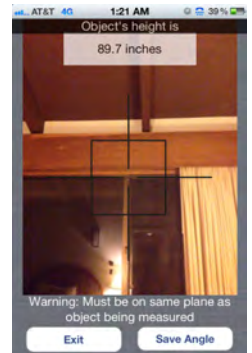
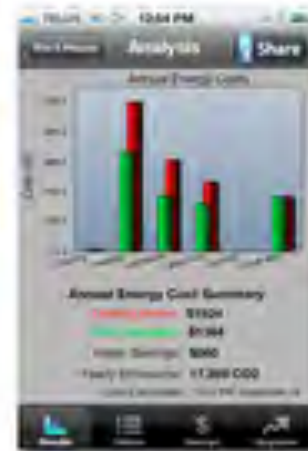
Microsoft *hohm*

- Who: Microsoft
- What: Consumer education



Mobile App: iViro

- Who: Envirolytics
- What: Consumer education & lead generator
 - Uses other apps to facilitate inputs
 - Compass for orientation
 - Camera + geometry for estimating wall heights and areas.



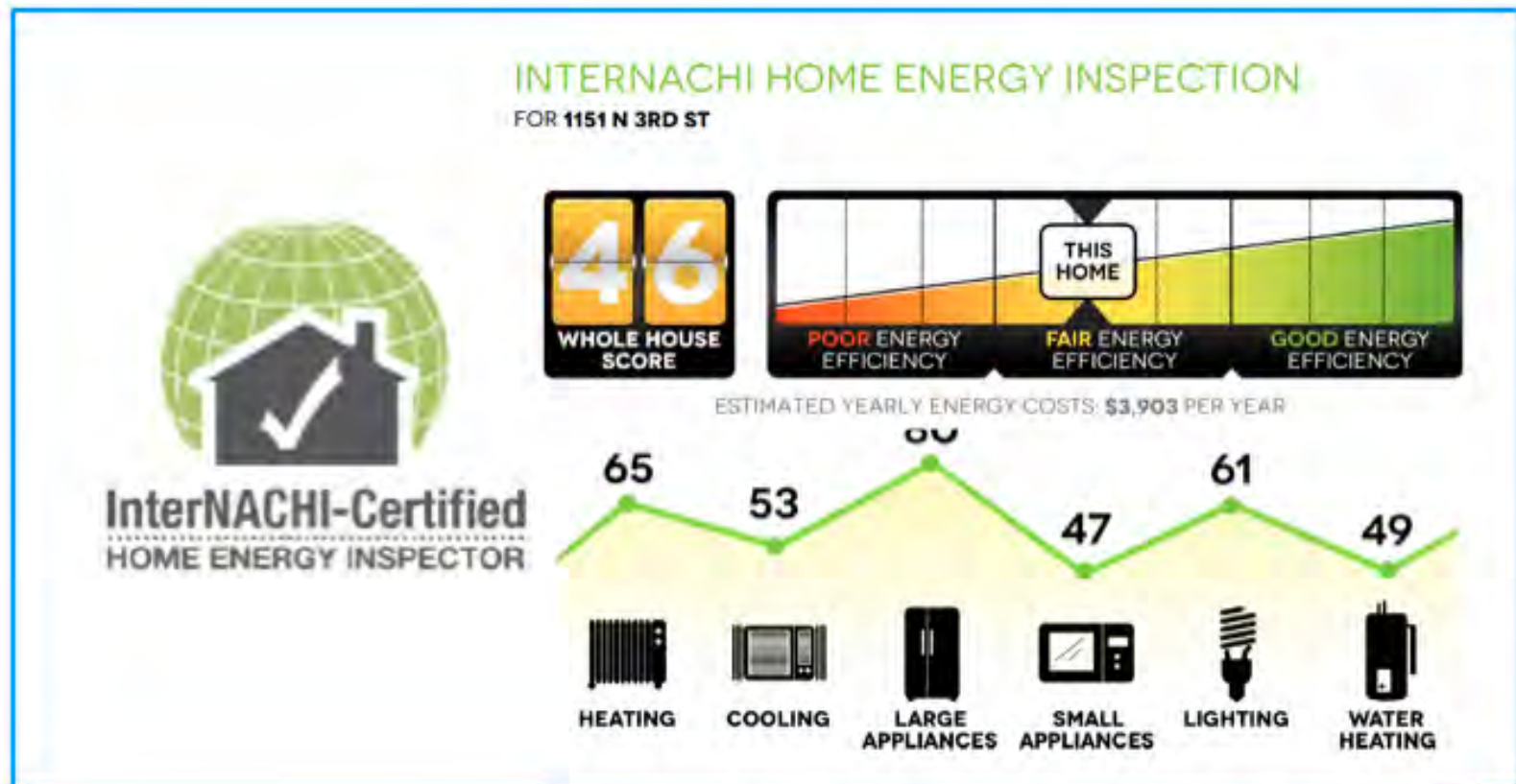
Consumer Tool

- Who: WattzOn
- What: Consumer education & lead generator



Home Inspector Tool

- Who: InterNACHI
- What: Home rating and tool for members



Home Energy Scoring Tool: iOS (iPhone, iPad) Android (Phone, Galaxy Tab)

- Who: MNCEE
- What: Scores plus software for project mg't



DOE WAP - MulTEA

- Who: ORNL
- What: Official tool for weatherization audits

Weatherization Assistant - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Weatherization Assistant

omni.adventgroup.com/rev/8

Weatherization Assistant • Agency • Client • Audit • User • Options • Help •

Welcome 0 Logout

Job #: 654
Name: Mini's audit from sp
Record: 0
EPD: 0
LPD: 0

Run

General
Client
Audit
Building

Shell
Walls
Windows
Doors
Roof
Floor

Systems
HVAC
Infiltration/Vent.
Water Heating
Distribution System

Lighting & Appliances
Lighting
Appliances/Equip.
Refrigerator
Laundry

Itemized Costs
Overall

Utility Bills

Icon Key
Audit is Required
Audit is Recommended
Audit is Optional
Item Complete
Item has been started

Building

Building Size and Occupancy
Number of Dwelling Units: 12
Gross Floor Area of Building (sq ft): 12900
Number of Floors Above Grade: 3
Number of Floors Below Grade: 0
Average Floor Height (ft): 10

Site Grade Changes:
Elevation of First Floor Above Grade (ft): 0
Total Height of Building Below Grade (ft): 0
Depth of Ground Below Grade:
On the Back (ft): 0
On the Right (ft): 0
On the Front (ft): 0
On the Left (ft): 0

Number of Occupants:
During Daytime: 12
During Nighttime: 48

Site Definition
Site Shielding: Moderate
Site Terrain: Sub Urban

Building Layout
Building Shape: Linear/Box
Hallway Configuration: Double-loaded
Hallways Are Conditioned: ☐
Orientation of Building (deg): 0

Number of Dwelling Units by Floor:
Top Floor: 4
Intermediate Floor: 4
Ground Floor: 4
Basement: 0

Area of Spaces
Area of Spaces by Floor

Floor	Units	Hallways	Other Conditioned Spaces	Other Unconditioned Spaces	Floor Sum
A3	4000	300	0	0	4300
A2	4000	300	0	0	4300
A1	4000	300	0	0	4300
B1	0	0	0	0	0
B2	NA	0	0	0	0
Totals:	12000.0	900.0	0.0	0.0	12900.0

Area of Endused Spaces (sq ft)

Number of Dwelling Units

Basement Ground Floor Intermediate Floor Top Floor

☐ Exposed Walls in one orientation

☒ Exposed Walls in two adjacent orientations

☐ Exposed Walls in two opposite orientations

☐ Exposed Walls in three orientations

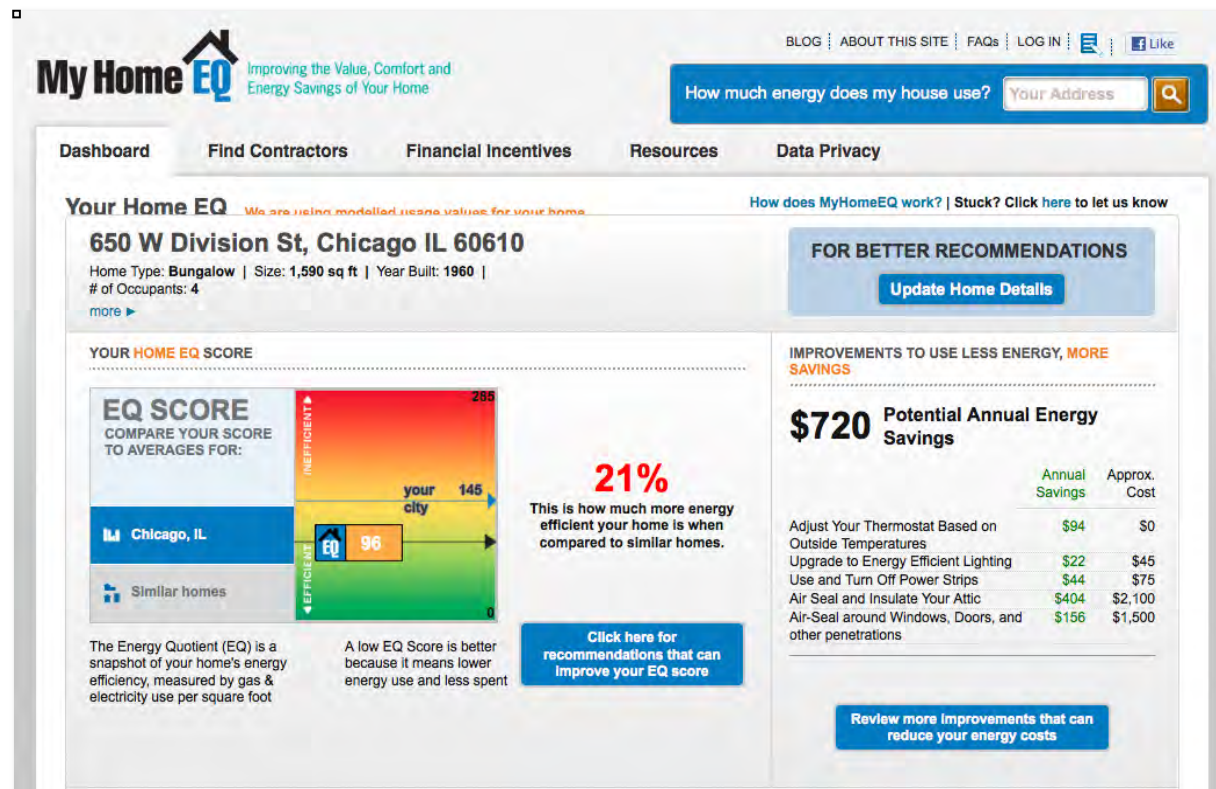
☐ Exposed Walls in all orientations

Delete OK Apply Cancel

1280x1024

MyHome-EQ

- Who: CNT spinoff
- What: Home rating + lead generation



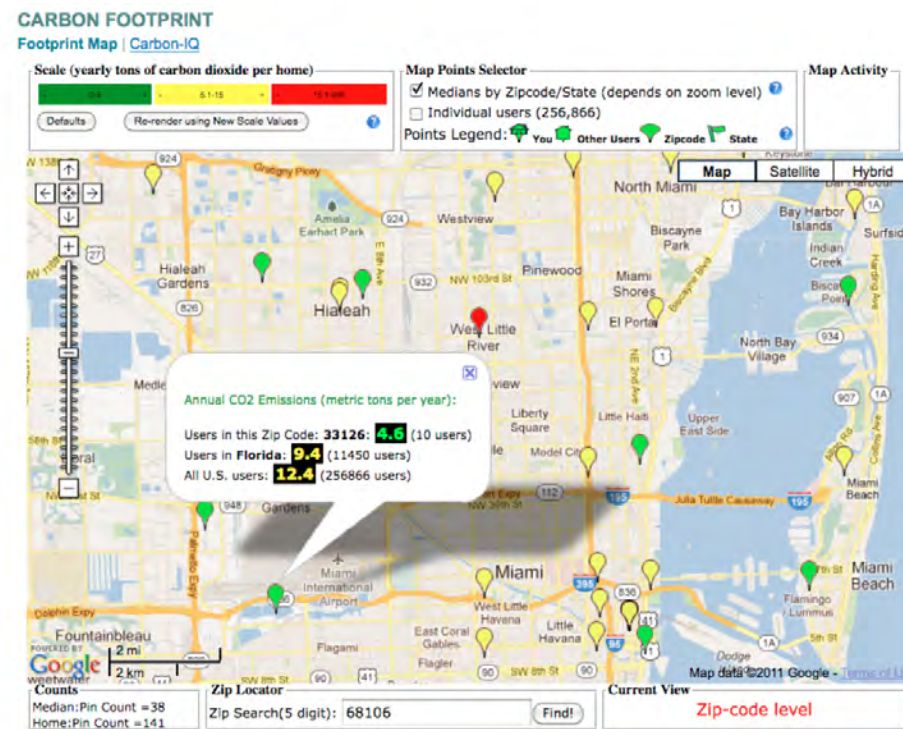
CoolCalifornia

- Who: California Air Resources Board
- What: Carbon calculators for homes and businesses



Future Directions


- Embedded *inside* devices (e.g. TSTATS)
- EMS integration
- Mash
- Etc...



Take-aways

- APIs are powerful new technologies for energy modeling
- Public R&D investment is enabling private-sector innovation in user-interfaces and delivery, eliminating bottlenecks, and (potentially) supporting back-end standardization
- The public sector is a good place for developing APIs
 - There's no money in it
 - Innovative mode of technology transfer
 - Non-proprietary (no particular product or fuel orientation)
 - Staying power
- Not for the faint of heart
 - Development is grueling
 - Users are demanding
 - Stakes are high (others depend on your service)
- Users are (understandably) fickle


https://developers.buildingsapi.lbl.gov/

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This site provides everything website developers need to access our APIs for analyzing energy use in residential and commercial buildings. Read about how people are [using our APIs](#)




Home Energy Saver

The Home Energy Saver tool suite and APIs—the culmination of a decade and a half of development by the U.S. Department of Energy's [Lawrence Berkeley National Laboratory](#)—provides web-based residential energy calculators for [consumers](#) and [professionals](#). These tools provide customized estimates of residential energy use, energy bills, and greenhouse-gas emissions, based on information provided by the user. The service identifies and ranks potential energy-saving strategies for any home.

[Release History](#)

[Licensing information](#)


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Scoring Tool

The [Home Energy Scoring Tool](#) provides an "asset rating" of a home's energy use under standardized occupancy and operational conditions. Qualified assessors can gather the information needed to assess a home in one short site visit. The tool underpins the U.S. Department of Energy's new [Home Energy Score Program](#), designed to label homes across the country. With these APIs, approved software developers can generate home energy scores as a stand-alone service or as an add-on to a home inspection or comprehensive energy assessment.

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EnergyIQ

The [EnergyIQ](#) action-oriented benchmarking system enables users to compare the energy performance of a non-residential building to a user-defined peer group, and generates an opportunity assessment with general recommendations on how to save energy and money, while reducing greenhouse-gas emissions.

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emills@lbl.gov